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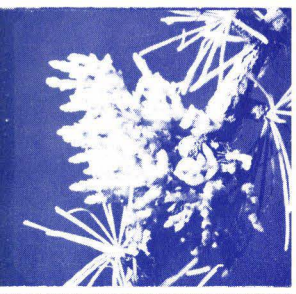

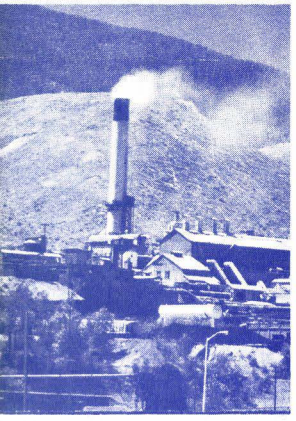

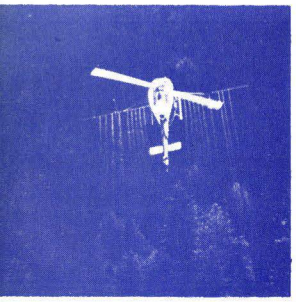

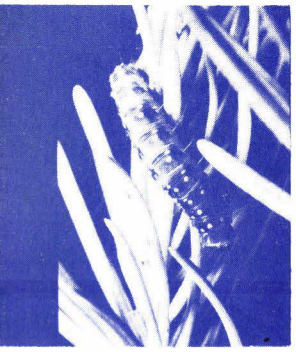

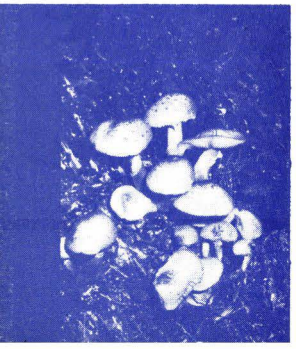

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Report No. 78-18

3400
November 1978

NONEFFECTIVENESS OF *RIBES* ERADICTION AS A CONTROL OF WHITE PINE BLISTER RUST IN YELLOWSTONE NATIONAL PARK

By

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ABSTRACT

Eradication of *Ribes* spp. to control white pine blister rust in Yellowstone National Park was started in 1947. In 1968 this study was initiated to evaluate the previous control effort. *Ribes* eradication was suspended in 1968 in 18 white pine stands and *Ribes* and rust were allowed to increase within rust control units. Eleven stands outside eradication units were selected as checks. In 1968, and again in 1978, percent rust infection on pine and the importance of *Ribes* were determined. Neither rust nor *Ribes* increased during the 10-year period; both were essentially absent from the "eradicated" stands in 1968 and 1978. Even though *Ribes* populations were comparatively high in the noneradicated stands, incidence of rust was nearly absent. The data show that the eradication of *Ribes* in Yellowstone has had little or no effect on spread and intensification of rust in the Park.

INTRODUCTION

Based on field studies that showed the ineffectiveness of *Ribes* spp. eradication for control of white pine blister rust (*Cronartium ribicola* J. C. Fisch.) on National Forest lands of Region 1, the Forest Service discontinued its blister rust control program in 1968 (Carlson and Toko, 1968). However, Berg et al. (1975) pointed out that ecological conditions in Yellowstone National Park are different from northern Idaho and may be limiting to rust spread and intensification in the Park. Also, the eradication units were much larger in Yellowstone than on the National Forest and the influence of unit size on rust

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spread and intensification may have been different than in Idaho. Brown and Carlson (1968), through the use of a cluster incidence survey, showed that rust levels were quite low in Yellowstone even in areas where Ribes populations were high. Thus, the basic question asked was, "Has the eradication of Ribes in Yellowstone Park been effective in limiting the spread and development of blister rust?"

METHODS

Berg et al (1975) described the methodology for this evaluation and it is reviewed here. An area of 22,640 acres in the Mt. Washburn unit was eradicated of Ribes to a 0/0 standard (0 Ribes and 0 feet of live stem per acre) between 1968 and 1970. Nine whitebark pine (Pinus albicaulis Engel.) stands within the area and seven stands just outside the area were chosen and a cluster survey (Brown and Carlson, 1968) to determine the proportion of pine stems infected by rust was done in each (figure 1). Subsequently, the area within the control unit was not reworked for Ribes for 10 years. At the end of this period, in 1978, the cluster survey was applied again in each stand. Ribes populations were assessed by counting the number of Ribes and estimating the cubic foot volume of air space occupied by each plant on plots 66 feet long by 13.2 feet wide associated with each detailed tree. It was assumed in 1968 that during the 10-year period Ribes would increase and provide increased substrate for the rust to complete its life cycle. Thus, rust theoretically should have increased, providing that ecological conditions were favorable.

Besides the 16 stands associated with the Mt. Washburn area, 13 other whitebark pine stands, 9 of which had Ribes removed in 1972 and 4 of which had no eradication history, were selected to expand the Washburn study. Evaluation methods were the same as for stands in the Washburn unit.

Figure 1.--Mixed stand of whitebark pine and subalpine fir. Mt. Washburn is in the backbround.

RESULTS AND DISCUSSION

Pertinent data are shown in table 1. Rust incidence is expressed as proportion of pine stems infected by rust and Ribes populations are given as an importance index. Importance equals Ribes volume per acre multiplied by frequency. Frequency was defined as the total number of Ribes plants divided by the total number of plots in the stand. An importance value of 0.00 means that no Ribes were found.

Blister rust was found in only two stands with an eradication history. Stand #8 at Carnelian Creek had a $\hat{PI}$ (proportion infected) of .01 and stand #13 at Indian Creek had a $\hat{PI}$ = .01 (in each of these stands, only one canker was found). No rust was found in the other 16 stands. Collectively, of nearly 10,000 trees observed, only two were infected. Similarly, in the stands that never had been worked for Ribes, only two were infected and the $\hat{PI}$ of each was very low. Stand #2 on Mt. Washburn had a $\hat{PI}$ of .05 and stand #10 in Carnelian Creek had a $\hat{PI}$ of only .06.

Ribes spp. were found in only two stands with eradication history and the importance values were low, 1.57 and 0.01 in stands 8 and 9, respectively. However, Ribes were found in 6 of the 11 noneradicated stands and importance values ranged from 0.04 to 1040.96.

The average $\hat{PI}$ for eradicated stands was 0.00 in 1978 and 0.00 in 1968 and the mean importance value for Ribes was 0.09. Mean $\hat{PI}$ for noneradicated stands was 0.010 in 1978 and 0.004 in 1968 demonstrating a very slight increase over 10 years. Ribes, however, were fairly predominant and had an average importance of 116.49. This comparison between eradicated and noneradicated stands is shown in figure 2. Clearly, it is shown that the past effort to remove Ribes had little or no effect on white pine blister rust incidence. Rust infection has remained very low even though Ribes populations were rather extensive in some of the nonworked stands.

The cause of low rust incidence must be related to indigenous ecological factors. The high elevation stands (7,500 ft. m.s.l.+) abound with Ribes montigenum, a relatively nonsusceptible host. Also, temperatures and relative humidities may be adverse to rampant and extensive exploitation of whitebark pine by blister rust, which as pointed out by Krebill 1/, simply cannot occur.

CONCLUSIONS

A beneficial effect of Ribes eradication in Yellowstone National Park has not been shown. Rust incidence has remained at very low levels even though Ribes populations were relatively extensive in some areas. Ecological conditions within the Park probably limit rust spread quite effectively, eradication of Ribes clearly is not warranted, and the existence of white pine in the Park clearly is not threatened by the rust.

1/ September 10, 1969, memorandum from Dr. Richard Krebill, Forest Service Research, to Mr. Bill Hendricksen of Yellowstone National Park.

Table 1.--Rust infection and Ribes importance for stands sampled.

Stand no.	Location	1978 PI[1/]	1970 PI	1978 Ribes importance[2/]	Control unit status in/out	Date last Ribes removal	Infection trend
1	Grebe Lake	0.00	0.00	0.00	x	1968	0
3	Mt. Washburn	0.00	0.00	0.00	x	1968	0
4	Mt. Washburn	0.00	0.00	0.00	x	1968	0
6	Observation Peak	0.00	0.00	0.00	x	1968	0
7	Carnelian Creek	0.00	0.00	0.00	x	1968	0
8	Carnelian Creek	0.01	0.00	1.57	x	1968	+
9	Carnelian Creek	0.00	0.00	0.01	x	1968	0
11	Obsidian Cliff	0.00	0.00	0.00	x	1972	0
13	Indian Creek	0.01	0.00	0.00	x	1972	+
15	Lewis Lake	0.00	0.00	0.00	x	1967	0
17	Dunraven Peak	0.00	0.00	0.05	x	1968	0
22	Delacy Creek	0.00	0.00	0.00	x	1972	0
24	Dunraven Pass	0.00	0.00	0.00	x	1964	0
25	Pelican Creek	0.00	0.00	0.00	x	1972	0
26	Elephant Back Mt.	0.00	0.00	0.00	x	1972	0
27	Wolf Lake	0.00	0.00	0.00	x	1972	0
28	Norris Jct.	0.00	0.00	0.00	x	1972	0
29	Ochre Spring	0.00	0.00	0.00	x	1972	0
	Mean	0.00	0.00	.09			
2	Mt. Washburn	0.05	0.01	1040.96	x		+
5	Mt. Washburn	0.00	0.00	211.47	x		0
10	Carnelian Creek	0.06	0.02	20.22	x		+
12	Observation Peak	0.00	0.00	1.44	x		0
14	Lewis Lake	0.00	0.01	0.04	x		-
16	Dunraven Peak	0.00	0.00	0.00	x		0
18	Lamar	0.00	0.00	7.24	x		0
19	Tower Creek	0.00	0.00	0.00	x		0
20	Tower Creek	0.00	0.00	0.00	x		0
21	Tower Creek	0.00	0.00	0.00	x		0
23	Lewis Lake	0.00	0.00	0.00	x		0
	Mean	.0100	.004	116.49			

1/ PI = Proportion of stems infected by blister rust.
2/ Ribes importance = (Ribes vol/acre) x (total Ribes ÷ total plots sampled).

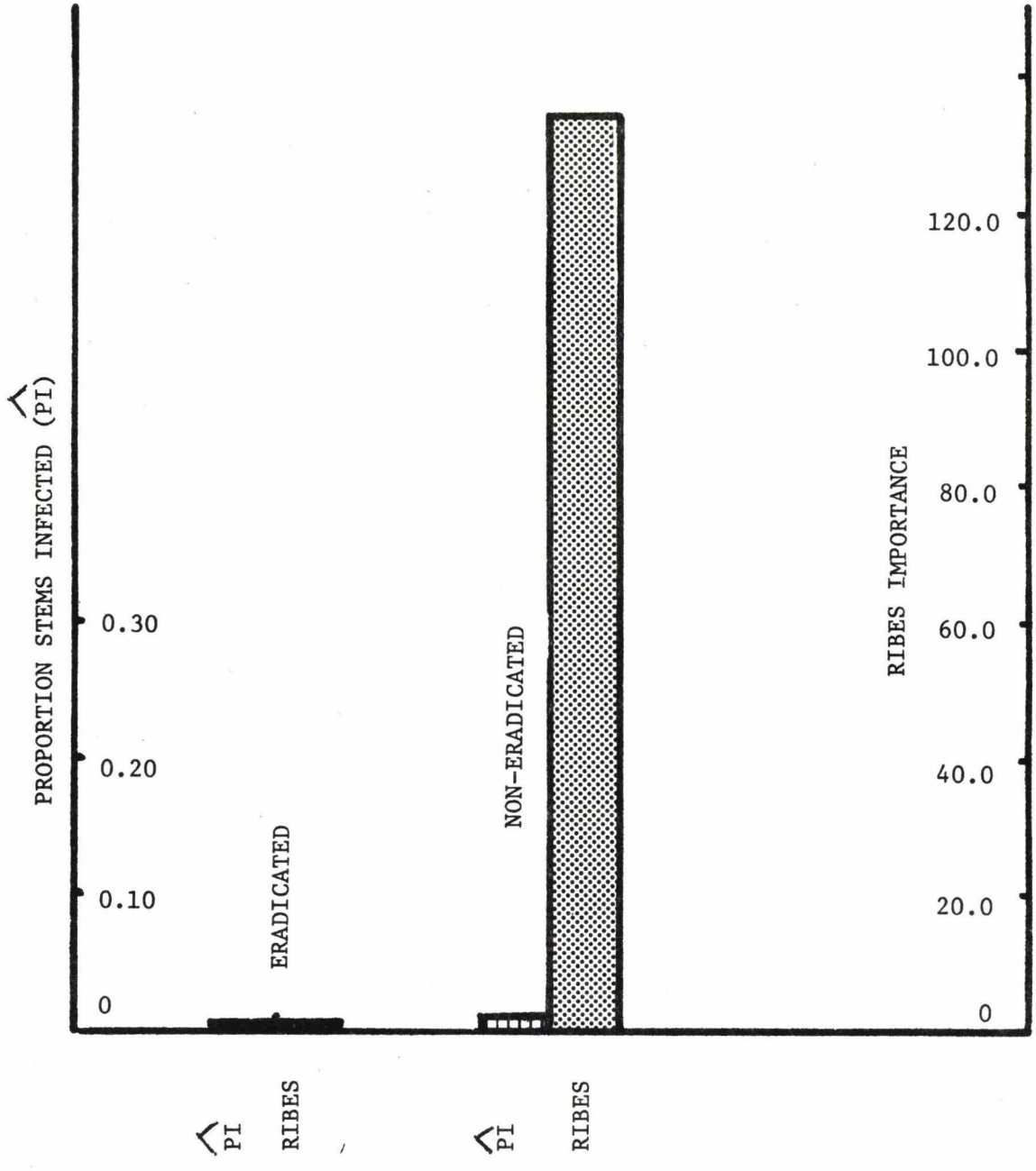

Figure 2.--Mean $\hat{PI}$ (proportion stems infected) and Ribes importance for eradicated and non-eradicated white pine stands in Yellowstone National Park. 1978 data.

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ACKNOWLEDGEMENTS

The assistance of Yellowstone Park employees Mr. Gary Beale, Mr. Jim Sweany, and their field crew is gratefully appreciated. Most of the field data was collected by them.